Chapter 6
# Conclusions

The conclusions which can be drawn from this study have been organized into two groups.

- The first includes those which can be drawn from the pipeline and leak database study conducted in accordance with California Government Code Section 51015.05.

- The second includes those conclusions which can be drawn from the incentive option investigation, also conducted in accordance with California Government Code Section 51015.05.

## 6.1 Database Findings

Although extensive efforts were taken to gather the most complete database possible, including the distribution of over 1,200 questionnaires aimed at identifying study participants, the resulting data set was relatively small. The data set can be summarized as follows:

| | |
|---|---|
| Number of incidents (≥1 bbl) | 10 |
| Number of pipelines | 113 |
| Total length of pipelines (miles) | 496 |
| Mean diameter of pipe (inches) | 7.5 |
| Mean operating temperature | 74.21F |
| Cathodically protected pipe (miles) | 317 (64% of total) |
| Bare pipe (miles) | 87 (18% of total) |
| Median spill size (bbl) | 3 |
| Average spill size (bbl) | 122 |
| Median damage ($US 1994) | $5,000 |
| Average damage ($US 1994) | $39,020 |
| Length of Underground Pipe (miles) | 478 (96.3% of total) |

## Overall Incident Rates

The overall leak incident rate for leaks of one barrel or more from the crude oil pipelines under study was very similar to the hazardous liquid pipelines currently regulated by CSFM - 6.72 versus 6.54 incidents per 1,000 mile years respectively. However, the incident rate for larger spills was generally much less for the smaller, crude oil pipelines in this study. The results for these crude oil gathering lines are summarized as follows:

| **Spill Event** per 1,000 mile years | **Incident Rate** |
|---|---|
| ≥1 bbl | 6.72 |
| ≥10 bbl | 2.02 |
| ≥100 bbl | 1.10 |
| ≥1,000 bbl | 0.69 |
| ≥10,000 bbl (per 1,000 mile years) | 0.00 |
| ≥$1,000 damage ($US 1994-per 1,000 mile years) | 6.72 |
| ≥$10,000 damage ($US 1994-per 1,000 mile years) | 1.34 |
| ≥$100,000 damage ($US 1994-per 1,000 mile years) | 1.14 |
| ≥$1,000,000 damage ($US 1994-per 1,000 mile years) | 0.00 |
| Injury (per 1,000 mile years) | 0.00 |
| Fatality (per 1,000 mile years) | 0.00 |

## External Corrosion

External corrosion was by far the leading cause of incidents in this study, representing 60% of the total. However, with the limited data sample, we were unable to isolate the cause. The results of the 1993 study regarding CSFM-regulated pipelines indicated that pipe operating temperature and age were the two leading factors contributing to increased external corrosion. We suspect that this is also the case for the crude oil pipelines under study. However, the data set was too small to perform a conclusive analysis.

**Recovery of Spilled Volumes**

The operators reported that the ten leaks which occurred during the three-year study period resulted in an estimated 1,221 barrels of spilled crude oil. Roughly two-thirds (800 barrels) of this volume was recovered.

**Injuries and Fatalities**

No injuries or fatalities occurred on the California crude oil pipelines under study during the three year study period. However, the data sample was too small to be useful.

For example, if one simply applied the fatality rate or 0.042 fatalities per 1,000 mile years (which was established in the 1993 report on CSFM-regulated hazardous liquid pipelines) one would anticipate a fatality every 16 years for the 496 miles of crude oil pipelines under study. This recurrence interval is greater than the three year study period. As a result, one would not expect a fatality during this study period. Further, as discussed above, the risk to human life from crude oil spills is likely less than for refined petroleum product pipelines which would tend to increase the recurrence interval.

## 6.2 Incentive Option Investigation Findings

After compiling all of the study information on incentive options and barriers to pipeline replacement and/or improvement, a number of conclusions or findings can be drawn. This section summarizes these findings and provides recommendations to improve pipeline safety (public safety) and environmental protection, maintain adequate regulatory control, and allow pipeline operators to make sound business/economic decisions.

Most findings presented in this section were taken directly from responses to the questionnaire and from the case studies that were submitted. As noted above, the rate of response to the battery of questions on barriers was relatively low for the participating regulatory agencies. Therefore, it is important to remember that the findings and recommendations presented here do not necessarily reflect those that would have been obtained if a larger number of regulators had provided input. The major findings are summarized below:

! jurisdictional authority is not well defined,

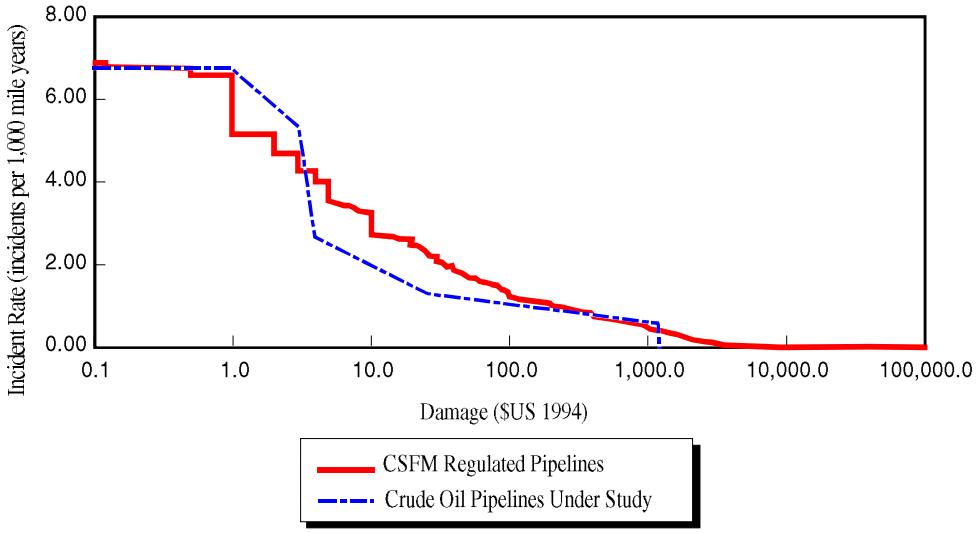
! permitting requirements overlap,

- there is no lead agency for permitting,
- compliance requirements vary from agency to agency and from location to location,
- permitting process is often too slow,
- some permits require overly burdensome testing,
- some pipeline repair and replacement projects, including routine maintenance, are not being done, and
- incentives to repair, replace and improve pipelines do not exist or have proven ineffective.

The following table lists some of the regulatory agencies involved in pipeline issues.

| State | Federal | Local |
|---|---|---|
| Coastal Commission | Minerals Management Service | Resources Management Department |
| State Lands Commission | Department of Transportation | Public Works Department |
| Department of Parks and Recreation | Environmental Protection Agency | Fire Department |
| State Water Quality Control Board | Coast Guard | Environmental Health Department |
| State Fire Marshal | National Marine Fisheries Service | Board of Architectural Review |
| Department of Fish and Game | Fish and Wildlife Service | Air Pollution Control District |
| Air Resources Board | Bureau of Land Management | Systems Safety and Reliability Review Cmtee |
| Department of Transportation (Caltrans) | | Zoning Department |
| | | Planning Department |
| | | Building Department |

Table 6-1A
**Spill Size Distribution**
**CSFM Regulated Pipelines versus Crude Oil Pipelines Under Study**
Spill Size versus Incident Rate – Logarithmic Scale




**Spill Size Distribution**
**Spill Size versus Cumulative Percentage of Incidents**
0 to 100 Barrels Only

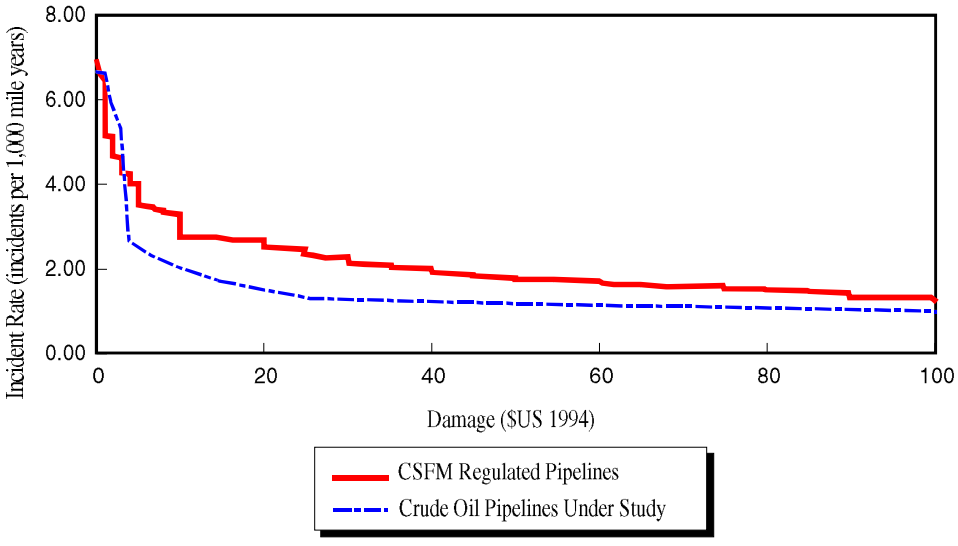
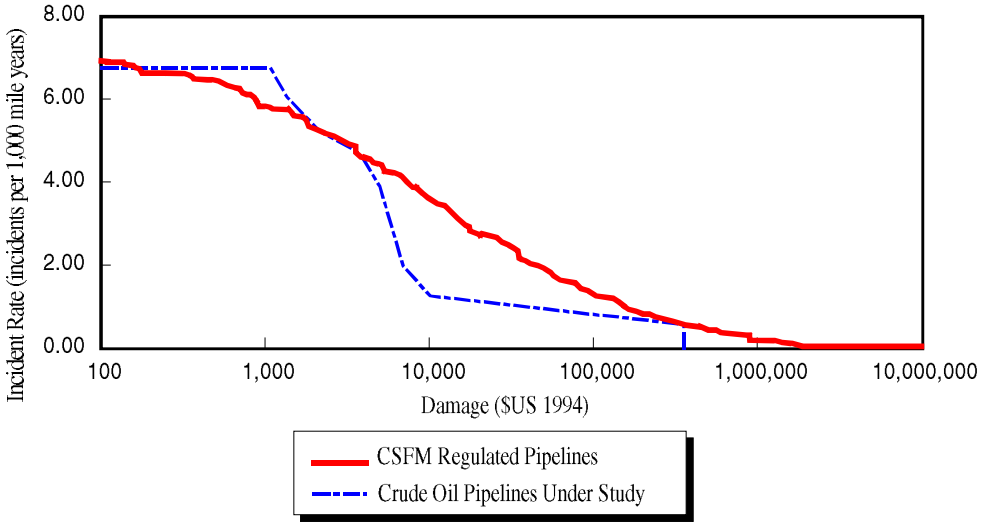


Table 6-1B
**Property Damage Distribution**
**CSFM Regulated Pipelines**
Versus Crude Oil Pipelines Under Study Incident Rate – Logarithmic Scale




**Damage Distribution**
**Logarithmic Scale**